## In the Claims

Add new claims 66-102 as follows.

- 66. A nucleic acid sequence encoding P39.5 or a fragment thereof, which is selected from the group consisting of:
- (a) a nucleic acid sequence encoding P39.5 or a fragment thereof, isolated from cellular materials with which it is naturally associated;
  - (b) a nucleic acid sequence ATCC Accession No. 98478
  - (c) SEQ ID NO:1 or a sequence complementary thereto;
  - (d) SEQ ID NO: 3 or a sequence complementary thereto;
  - (e) SEQ ID NO: 4 or a sequence complementary thereto;
  - (f) SEQ ID NO: 5 or a sequence complementary thereto;
  - (g) SEQ ID NO: 6 or a sequence complementary thereto;
  - (h) SEQ ID NO: 7 or a sequence complementary thereto;
  - (i) SEQ ID NO: 8 or a sequence complementary thereto;
  - (j) SEQ ID NO: 9 or a sequence complementary thereto;
  - (k) SEQ ID NO: 10 or a sequence complementary thereto;
  - (l) SEQ ID NO: 11 or a sequence complementary thereto;
  - (m) SEQ ID NO: 12 or a sequence complementary thereto;
  - (n) SEQ ID NO: 13 or a sequence complementary thereto;
  - (o) a sequence which hybridizes to any of (a) through (n)

under stringent conditions;

- (p) an allelic variant of any of (a) through (o);
- (q) a fragment of any of (a) through (o) comprising at least 15 nucleotides in length;
  - (r) a deletion mutant of (a), (b), (c) (d) or (n), and
- (s) a sequence encoding P39.5 or a fragment thereof fused to a sequence encoding a second protein.

- 67. A protein or polypeptide selected from the group consisting of:
- (a) an isolated P39.5 protein which is expressed *in vitro* by *Borrelia garinii* strain IP90 spirochetes, and has a relative molecular mass of 39,500 daltons;
  - (b) a protein comprising the amino acid sequence of SEQ

ID NO: 2;

(c) a protein comprising the amino acid sequence of SEQ

ID NO: 14;

- (d) a fragment of (a) (c);
- (e) an analog of (a) (c) characterized by having at least 80% homology with SEQ ID NO: 2 or 14;
- (f) a homolog of (a) (c) characterized by having at least 80% homology with SEQ ID NO: 2 or 14.
- (g) a fusion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14, or an analog, homolog or fragment thereof fused to a second protein;
- (h) a fusion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14 to which are added fragments that are up to 95% identical to SEQ ID NO: 2 or 14;
- (i) a deletion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14 with one or more amino acids deleted therefrom;
- (j) a protein of any of (a)-(i), which is chemically synthesized; and
- (k) a protein of any of (a)-(j) which is a recombinant protein.
- 68. A vector comprising a nucleic acid sequence encoding P39.5 or a fragment of claim 66 under the control of suitable regulatory sequences.
  - 69. A host cell transformed with the vector according to claim 68.

- 70. A diagnostic reagent comprising a nucleic acid sequence of claim 66 and a detectable label which is associated with said sequence.
- 71. The antibody according to claim 16, isolated by immunizing said host with a protein or polypeptide selected from the group consisting of:
- (a) an isolated P39.5 protein which is expressed *in vitro* by *Borrelia garinii* strain IP90 spirochetes, and has a relative molecular mass of 39,500 daltons;
  - (b) a protein comprising the amino acid sequence of SEQ

ID NO: 2;

(c) a protein comprising the amino acid sequence of SEQ

ID NO: 14;

- (d) a fragment of (a) (c);
- (e) an analog of (a) (c) characterized by having at least 80% homology with SEQ ID NO: 2 or 14;
- (f) a homolog of (a) (c) characterized by having at least 80% homology with SEQ ID NO: 2 or 14.
- (g) a fusion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14, or an analog, homolog or fragment thereof fused to a second protein;
- (h) a fusion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14 to which are added fragments that are up to 95% identical to SEQ ID NO: 2 or 14;
- (i) a deletion protein comprising the amino acid sequence of SEQ ID NO: 2 or 14 with one or more amino acids deleted therefrom;
- (j) a protein of any of (a)-(i), which is chemically synthesized; and
- (k) a protein of any of (a)-(j) which is a recombinant protein.

- 72. The antibody according to claim 16, which is isolated by affinity purifying antiserum generated during an infection of rhesus monkeys with JD1 spirochetes using as immunoabsorbant the P39.5 protein of *B. garinii* or a fragment thereof.
- 73. A vaccine composition comprising an effective amount of a P39.5 protein, fusion protein or fragment of claim 67 and a pharmaceutically acceptable carrier.
- 74. The composition according to claim 73 wherein said fragment is selected from the group consisting of P7-1, P1-1, P3-1, P6-1, P9-1, and P12-1.
- 75. The composition according to claim 73 wherein said composition comprises at least one other *B. burgdorferi* antigen or fragment thereof.
- 76. The composition according to claim 75 wherein said other antigen is selected from the group consisting of OspA, OspB, OspC, BmpA, BmpB, BmpC, BmpD and fragments or variants thereof.
- 77. The composition according to claim 73 wherein said composition comprises at least one other protein or fragment thereof which has a sequence homologous to that of P39.5 or a fragment thereof.
- 78. The composition according to claim 73 comprising a mixture of individual proteins.
- 79. The composition according to claim 75 wherein said P39.5 protein or fragment and said other antigen are in the form of a fusion protein.

- 80. A method of vaccinating a human or animal against Lyme

  Disease comprising administering to said human or animal a composition comprising
  an effective amount of the composition of claim 73.
- A kit for diagnosing infection with B. burgdorferi in a human or animal comprising a P39.5 protein or fragment thereof of claim 67.
- 82. A kit for diagnosing infection with B. burgdorferi in a human or animal comprising an anti-P39.5 antibody of claim 16.
- P39.5 or a fragment thereof, comprising the steps of contacting said P39.5 protein or fragment of claim 67 with a test compound to permit binding of the test compound to P39.5; and determining the amount of test compound which is bound to P39.5.
  - 84. A compound identified by the method of claim 83.
- 85. A vector comprising a nucleic acid sequence encoding a B. garinii cassette string protein or fragment thereof of claim 38 under the control of suitable regulatory sequences.
  - 86. A host cell transformed with the vector according to claim 85.
- 87. A method of recombinantly expressing a *B. garinii* cassette string protein or peptide fragment thereof comprising the steps of culturing a recombinant host cell transformed with a nucleic acid sequence of claim 38 encoding said protein or fragment under conditions which permit expression of said protein or peptide.

- 88. The method according to claim 87 further comprising the step of isolating said expressed protein from said cell or said cell medium.
- 89. The method according to claim 87 wherein said *B. garinii* cassette string protein or peptide fragment is a fusion protein or a deletion mutant protein.
- 90. The antibody according to claim 47, isolated by immunizing said host with the protein or a fragment thereof of the *B. garinii* cassette string selected from the group consisting of P1-1, P3-1, P6-1, P7-1, P9-1 and P12-1 or a mixture of said cassette string proteins.
- 91. A vaccine composition comprising an effective amount of at least one *B. garinii* cassette string protein of claim 39, a fusion protein or a fragment thereof and a pharmaceutically acceptable carrier.
- 92. The composition according to claim 91 comprising a mixture of different B. garinii cassette string proteins or fragments.
- 93. The composition according to claim 91 comprising at least one other B. burgdorferi antigen or fragment thereof.
- 94. The composition according to claim 93 wherein said other antigen is selected from the group consisting of OspA, OspB, OspC, BmpA, BmpB, BmpC, BmpD and fragments or variants thereof.
- 95. The composition according to claim 91 comprising P39.5 or at least one other protein or fragment thereof which has a sequence homologous to P39.5.

96. A method of vaccinating a human or animal against Lyme

Disease comprising administering to said human or animal a composition comprising
an effective amount of the composition of claim 91.

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- 97. A method for diagnosing Lyme borreliosis in a human or animal comprising the steps of incubating an anti-B. garinii cassette string protein antibody of claim 47 with a sample of biological fluids from a human or animal to be diagnosed, wherein in the presence of B. burgdorferi an antigen-antibody complex is formed, and subsequently analyzing said fluid sample for the presence of said complex.
- 98. A therapeutic composition useful in treating humans or animals with Lyme disease comprising at least one *B. garinii* cassette string protein antibody of claim 47 or fragment antibody and a suitable pharmaceutical carrier.
- 99. A method for treating Lyme Disease in a vertebrate host comprising administering an effective amount of a composition according to claim 98.
- 100. A kit for diagnosing infection with B. burgdorferi in a human or animal comprising a B. garinii cassette string protein or fragment thereof of claim 39.
- 101. A kit for diagnosing infection with B. burgdorferi in a human or animal comprising an antibody of claim 47.
- B. garinii cassette string protein or fragment thereof, comprising the steps of contacting said protein or fragment of claim 39 with a test compound to permit binding of the test compound to said B. garinii cassette string protein or fragment; and determining the amount of test compound which is bound to said protein or fragment.
  - 103. A compound identified by the method of claim 102.